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الرقم

System classification:-

- Linear, non linear
- Static, dynamic
- Shift invariant, variant
- Causal, non-causal
- Stable, unstable

--- >> Sheet 2 <<---

Q1:- # $y(n) = nx(n)$

* linearity: (linear)

$$y_1 = nx_1(n)$$

$$y_2 = nx_2(n)$$

$$x_1(n) + x_2(n) \rightarrow y_3(n) = (x_1(n) + x_2(n))$$

$$= nx_1(n) + nx_2(n) = y_1 + y_2$$

* Static (Depends only on current input)

$$* y(n, k) = nx(n-k)$$

$$y(n-k) = (n-k)x(n-k)$$

$$y(n, k) \neq y(n-k)$$

⇒ Shift variant

* Causal System

(doesn't depend on future input)

* unstable

سؤال 2 م. جواب

For $y(n) = ax(n)$

- * Stable
- * Shift invariant
- * Causal
- * Static
- * linear

$y(n) = x(n^2)$

$$y(n) = x(n^2)$$

$$x_1(n) \rightarrow x_1(n^2)$$

$$x_2(n) \rightarrow x_2(n^2)$$

$$x_1(n) + x_2(n) \Rightarrow x_1(n^2) + x_2(n^2)$$

$$= y_1 + y_2 \quad (\text{Linear})$$

* Non Causal

* Stable

* Dynamic

$$y(n, k) = x(n^2 - k)$$

$$y(n-k) = x((n-k)^2)$$

$$y(n, k) \neq y(n-k)$$

⇒ Shift variant

Turn Over



$$\# y(n) = x(n) + 3u(n+1)$$

$$\begin{aligned} * x_1(n) &\rightarrow x_1(n) + 3u(n+1) \\ x_2(n) &\rightarrow x_2(n) + 3u(n+1) \\ x_1(n) + x_2(n) &\rightarrow x_1(n) + x_2(n) + 3u(n+1) \end{aligned}$$

$$\# y_1 + y_2 \text{ (Non Linear)}$$

* Non Causal

* Dynamic

* Stable

$$* y(n, k) = x(n-k) + 3u(n+1)$$

$$y(n-k) = x(n-k) + 3u(n+1-k)$$

\Rightarrow Shift variant

$$\# y(n) = g(n)x(n)$$

* Linear

* Static

* Shift variant

* Causal

* Stable

Convolution :-

$$y(n) = \sum_{k=-\infty}^{\infty} x(k)h(n-k)$$

$$Q_2: x(n) = \{1, 2, -1\}$$

$$h(n) = x(n)$$

$$\text{at } n=0 \Rightarrow y(0) = \sum_{k=0}^2 x(k)h(-k)$$

$$= x(0)h(0) + x(1)h(-1)$$

$$+ x(2)h(-2) = 1$$

$$\text{at } n=1 \Rightarrow y(1) = \sum_{k=0}^1 x(k)h(1-k)$$

$$= x(0)h(1) + x(1)h(0)$$

$$= 2 + 2 = 4$$

$$\text{at } n=2 \Rightarrow y(2) = \sum_{k=0}^2 x(k)h(2-k)$$

$$= x(0)h(2) + x(1)h(1) + x(2)h(0)$$

$$+ x(2)h(0)$$

$$= -1 + 4 + -1 = 2$$

$$\text{at } n=3 \Rightarrow y(3) = \sum_{k=0}^3 x(k)h(3-k)$$

$$= x(0)h(3) + x(1)h(2) + x(2)h(1) + x(3)h(0)$$

$$= -2 - 2 = -4$$

$$\text{at } n=4 \Rightarrow y(4) = \sum_{k=0}^4 x(k)h(4-k)$$

$$= x(0)h(4) + x(1)h(3) + x(2)h(2) + x(3)h(1) + x(4)h(0)$$

$$= 1$$

$$y(n) = x(n) + 0.5x(n-1)$$

$$+ 0.25x(n-2)$$

$$y(0) = 1$$

$$y(1) = 1.5$$

$$y(2) = 1.75$$

$$y(3) = 1.75$$

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